BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PATENT SPECIFICATION

(11) 1 243 977

DRAWINGS ATTACHED

1 243 977

(21) Application Nos. 40466/67 (22) Filed 5 Sept. 1967
51305/67 11 Sept. 1967
6112/71 10 Nov. 1967

(23) Complete Specification filed 29 Aug. 1968

(45) Complete Specification published 25 Aug. 1971

(51) International Classification A 24 c 5/50

(52) Index at acceptance
A2C 1E2

(72) Inventor BERNHARD SCHUBERT

Stw.: Filter-pulver - Einfüllen - stösselstrom

(54) METHOD AND APPARATUS FOR PRODUCING FILTERS CONTAINING FILTER GRANULATE MATERIALS

(71) We, HAUNI-WERKE KÖRBER & Co. K.G., a German Company, of 14/18 Kampchaussee, Hamburg-Bergedorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a method for producing filters containing filter granulate materials for application to cigarettes or other tobacco articles in which the filter granulate is confined between stopper elements inserted in a portion of filter case material so that rod-like filters incorporating the filter granulate and closed at the ends by means of the stopper elements are produced. The invention further relates to apparatus for producing such filters for connection to cigarettes or other tobacco-containing articles consisting of tubular elements formed from a filter case material, for example paper and containing a filter granulate filling confined by means of stopper elements.

In the case of filters for tobacco goods it is desirable to filter out injurious substances such as tar-like products, to the maximum possible extent without substantially influencing the flavour. It has been discovered that this result can be obtained best by means of materials which can be produced so far only in the form of granulates. Such granulates as referred to herein consist of grains of material but independently of the sizes of the grains, and the term is thus intended to cover materials which would normally be referred to as powders. In the filtering of tobacco smoke it is important that the smoke should traverse the greatest possible superficial area of the granulate but the flow resistance should not be unduly great to ensure that the smoker will not have to draw or suck excessively strongly. The stopper elements referred to are selected from materials which are impervious to the powder or granulate filling used and may consist of short sections cut from a coherent rod-like body, but they are such as to offer a low resistance to air flow, and a mechanical filtering action.

The invention is directed to the problem of producing filters with a granulate filling at a satisfactory production speed in which the space provided for the filter granulate is completely filled with the granulate. This object is attained according to the invention by supplying to a filling point a succession of preformed tubes having a stopper element therein and inserting a filter granulate and a further stopper element into each tube while it is supported and conveyed in an upright position. The tubes may be supplied with a stopper element already provided therein but preferably the tubes are supplied without such elements and the method may then comprise inserting successively a stopper element, filter granulate and a further stopper element into the ends of pre-formed tubes supported and conveyed in an upright position.

A constructionally simple arrangement of the apparatus for carrying out the method according to the invention is referred to herein. Such apparatus may include measuring means arranged beside the feed path of holders for the tubes and in communication at the ends of a tube located in a holder during the transfer of a filter granulate filling into the tube. If several holders for the tubes and several means for positioning the stopper elements are provided in one apparatus to increase the output substantial mechanical complication would be involved; to reduce this provision is made according to the invention that the means for placing the stopper elements are formed by a plunger assembly movable in the direction of the longitudinal axes of the holders in which the individual plungers are operated together. In order that the stopper elements can be inser-

[Price 25p]

ted even during the movement of the holders, the means for placing the stopper elements consists of at least one plunger displaceable in the direction of the longitudinal axes of the holders and participating in the movement thereof transverse to the longitudinal axes. In order to provide a simple preliminary positioning of the stopper elements provision is made according to the invention that a holder for the defining elements is movably arranged in the direction of the longitudinal axes of the holders and adjacent the feed path thereof and coincident with the holders.

The invention will be further explained with reference to the accompanying drawings and as applied to constructional examples wherein:

Fig. 1 shows a filling drum of a filter production machine with the supply conveyors associated therewith, as seen from above, but in which the upper cam ring and the inserting plungers are omitted,

Fig. 2 is a section through the filling drum on the line II—II in Fig. 1,

Fig. 3 shows the first cutting region in section on the line III—III in Fig. 1,

Fig. 4 shows the first filling region of the filling drum on the line IV—IV in Fig. 1 in section,

Fig. 5 shows the first granulate measuring region on the line V—V in Fig. 1,

Fig. 6 shows the second cutting region in section on the line VI—VI in Fig. 1,

Fig. 7 shows the final filter inserting region on the line VII—VII in Fig. 1,

Fig. 8 is a view showing the method steps of the filter producing machine according to Figs. 1 to 7 during the assembly of the starting components,

Fig. 9 shows a rod with strips of thermoplastic adhesive,

Fig. 10 shows a tube which embodies strips of thermoplastic adhesive on the inner side,

Fig. 11 shows the parts of the apparatus adjacent to the support plunger in accordance with another construction of the filling drum in which the support plunger is operated with suction,

Fig. 12 shows another modification of a filter production machine seen from above diagrammatically,

Fig. 13 shows part of the filling drum of a filter production machine in section on the line XIII—XIII in Fig. 12,

Fig. 14 is a view showing the holder for the stopper-forming rods after the cutting region in the direction of the arrow XIV in Fig. 13, and

Fig. 15 shows a grooved drum of the delivery section with an associated needle drum.

The filter production machine shown in Fig. 1 consists of a feed drum for filter case material which serves at the same time as an assembly conveyor and is formed by a filling drum 6 rotatably supported on a vertical shaft 21. The filling drum 6 is associated with a grooved drum 2 as the means for feeding portions of filter case material in the form of tubes 1 and a further grooved drum 7 as means for feeding stopper-forming rods 15, consisting of a mechanical filtering material. The stopper elements may consist of regular or irregularly disposed cellulose or cellulose acetate fibres or of foamed material or other rigid air permeable materials which exert only a comparatively low resistance to an air current but the air passages in the filter material must be so fine that none of the the granulate in the filter can pass through them.

The grooved drum 2 and the grooved drum 7 are supported on a vertical shaft 5. Moreover a circular cutter 8, a filter granulate magazine 12, a further circular cutter 9, a further filter granulate magazine 11 and a grooved drum 14 serving as a take-off conveyor for the finished filters 68, are associated with the filling drum 6 in such manner that tubes 1 supplied by the filling drum 6 are moved past these components in sequence. The region on the filling drum 6 from the grooved drum 7 up to the grooved drum 14 comprises the feed path S of the filling drum 6. The grooved drums 2, 7 and 14 have grooves 2*a*, 7*a*, 14*a* on their peripheral surfaces and running parallel to the axes, these grooves being arranged at uniform distances one from the other. Stationary guide bars 16, 17 and 20 are arranged concentrically around the feed sections of the peripheries of the grooved drums 2, 7 and 14. The grooved drum 14 is associated with a heating drum 18 running parallel to it, the heated outer surface 18*a* of which lightly engages the filters 68 being conveyed in the grooves 14*a*.

The filter granulate magazines 11 and 12 extend downwardly in the form of delivery ducts 11*a* and 12*a* having exit openings 11*b*, 12*b*, and measuring bores 36 are caused to pass beneath said openings as explained below. The region in which the exit openings 11*b* and 12*b* of the filter granulate magazines 11 and 12 are in communication with the measuring bores 36 is referred to below as the measuring regions P and R respectively.

The construction of the filling drum 6 will be seen in Fig. 2 in section parallel to the axis. The grooved drums 2, 7 with the shaft 5 and the spindle 21 and the filter granulate magazine 11 are shown in Fig. 2. The spindle 21 is screwed vertically to a machine base plate 19 and a drum body 22 is supported on the spindle 21 by means of two bearings 23*a* and 23*b* this drum body comprising the rotatable part of the filling drum 6. The drum body 22 consists of a flanged sleeve 23 which receives the bearings 23*a* and 23*b* and a tubular filling ring 25 depending from the flange of the sleeve 23. The filling ring 25 has

grooves 27 running parallel to the axis which are distributed uniformly around the periphery on the outer side and in the centre region of the ring. The elements described below pertain to each groove 27 and they are therefore described only for one of such grooves.

A receiving bore 26 is arranged above the groove 27 serving as a holder for the tube 1. Likewise coincident with the groove 27 a measuring bore 36 is provided in the filling ring 25 above the receiving bore 26 which bore is separated by a narrow peripheral groove 37 from the receiving bore 26, said groove extending around the periphery of the filling ring 25. Plates 54 or 63 (Figs. 2 and 5 respectively) serving as closure members engage the groove 37 in the filling region and close from beneath the measuring bore or chamber 36.

A holding groove 45 coincident with the measuring bore 36 is arranged in the filling ring 25 above the measuring bore 36 and serves as a guide for the rod lengths 15. The lower end of the holding groove 45 includes an apertured protrusion 44 surrounding the rod 15 around the whole periphery. The holding groove 45 is at the end of an arm 43 of a lever 39 which is movable in the radial plane of the filling drum 6 and supported in a forked member 38 located on the inner side of the filling ring 25. A roller 41 is rotatably supported at the other end 50 of the lever 39 which rests against a cam disc 42 secured to the machine base 19. A coil spring 40 is disposed between the arm 43 and the filling ring 25.

The grooved drums 2 and 7 are arranged beside the drum body 22 in the region of the grooves 27 and in the region of the holding grooves 45 respectively. The lower end of the filling ring carries guide apertures 28 coincident with respective grooves 27 to house support plungers 3 supported to move parallel to the axis of the shaft 21. Each plunger 3 embodies at its lower end a fork 3*a* engaged by a compression spring 31 around the plunger 3 which presses at its other end against the filling ring 25. A roller 29 is rotatably supported in a groove 53 of the fork 3*a* and is forced by the compression spring 31 against a cam ring 4 secured to the machine base 19.

A ring member 24 is arranged on the flanged sleeve 23 above the filling ring 25 in which inserting plungers 46 are supported as the means for placing the stopper members 65, such plungers being housed in bores 24*a* coincidently with the receiving bores 26 and the respective grooves 27. A compression spring 52 is arranged around each plunger 46 and bears at the one end against the ring member 24 and at the other end against a fork 48 at the end of the inserting plunger 46 having a channel 49 in which a roller 51 is rotatably supported. The roller is forced against a cam ring 47 secured to the spindle 21 by the action of the compression spring 52.

The drum body 22 is driven by an inner toothed ring 32 at the lower end of the filling ring engaged by a gear wheel 33 secured to one end of a shaft 34 supported in the machine base 19 and having a further gear wheel 35 at the other end by which the rotary parts are driven from a motor, not shown.

An electric vibrator 55 is secured to the filling ring 25 on the inner side. Two slip rings 56 fixed to the filling ring 25 above the vibrator 55 are connected to the vibrator through connecting leads. Brushes 57 are supported in a casing 58 secured to the cam disc 42 and are forced against the slip rings 56 by springs 59.

The parts shown in Figs. 3 to 7 have already been shown and described with reference to Figs. 1 and 2 and these figures are sections at corresponding points to Fig. 1 to show various operating steps. Figs. 3 and 6 show how the circular cutters 8 and 9 operate directly over the upper end surface of the filling ring 25, and Fig. 5 shows how the outlet opening 12*b* of the filter granulate magazine 12 lies also directly over the upper end face of the filling ring 25 and how the closure plate 63 closes the bottoms of the measuring bores during filling.

Hereinafter the method of operation of the filter production machine according to Figs. 1 to 7 will be described with reference to Figs. 8, 9 and 10. Finished tubes 1 prepared in advance pass from the grooved drum 2 to the grooves 27 of the filling drum 6 and simultaneously rods 15 from which the stopper elements are cut are transferred to the holding grooves 45 from the grooved drum 7 (see Figs. 1, 2, 8A, 8B).

During the rotation of the filling drum 6 each support plunger 3 in turn is moved upwards by the cam ring 4 and slides a tube 1 into a receiving bore 26. The support plunger 3 remains in position supporting the tube 1 during the whole filling operation. Simultaneously the inserting plunger 46 moves downwardly by the action of the cam ring 47 and pushes the rod 15 along the holding groove 45 and through the aperture in the protrusion 44 to an extent such that the end part to be cut off is inserted into the measuring bore 36 (see Fig. 8C). During the movement of the measuring bore past the circular cutter 8 the part projecting into the measuring bore 36 is cut off so that a stopper element 61 is held in the measuring bore 36 and the remaining part 62 of the rod 15 is held in the aperture in the protrusion 44 (see Figs. 3 and 8D). In this section the measuring bore 36 serves as a holder for the stopper element 61.

During cutting, the cam ring 47 allows

compression spring 52 to lift the inserting plunger 46. During the further rotation of the filling drum 6 the cam disc 42 rocks lever 39 and moves the remaining part of the rod 62 out of the region between the measuring bore 36 and the inserting plunger 46 (see Figs. 4, 5 and 8E).

Thereafter the inserting plunger 46 moves downwardly again and pushes the stopper element 61 located in the measuring bore 36 through the latter and through the tube 1 until it is pressed against the support plunger 3 (see Figs. 4 and 8F). During further rotation of the filling drum 6 the measuring bore 36 moves into the measuring region R, that is to say, into the region of the outlet duct of the filter granulate magazine 12. In this zone the plate 63 lies within the groove 37 and closes the measuring bores 36 from below so that a measuring chamber is formed. Filter granulate falls from the magazine 12 into the measuring bores 36 as they pass the magazine and each bore is filled in turn (Figs. 5 and 8G). During the movement of the measuring bore 36 from the measuring zone R the portion of filter granulate standing above the measuring bore 36 is swept off by the wall of the delivery duct 12*a*. Then the measuring bore 36 moves past the end of the plate 63 and the measured portion of granulate 64 therein falls into the tube 1 (Figs. 6, 8G and 8H).

During the further rotation of the filling drum 6 the lever 39 with the holding groove 45 is moved back again to its starting position by the cam disc 42 and the inserting plunger 46 is moved downwardly by the action of the cam ring 47 so that the remaining part 62 of the rod 15 is partly inserted into the measuring bore 36 (see Fig. 8H). During the movement past the circular cutter 9 the inserted part, i.e. the stopper element 65, is cut off (see Figs. 6 and 8I). Now only the end portion of the part 62, which forms the stopper element 66 remains in the aperture in the protrusion 44. During the cutting the inserting plunger 46 is lifted and after cutting the holding groove 45 is moved outwardly by swinging the lever 39 from the region between the inserting plunger 46 and the measuring bore 36 (see Fig. 8K). The measuring bore 36 thus serves as a holder for the stopper elements 65.

During the further rotation of the filling drum 6 the inserting plunger 46 is moved downwardly and pushes the stopper element 65 to about the centre of the tube 1. Thereby portions of the filter granulate which might possibly remain in the measuring bore 36 or in the upper part of the tube 1 are pushed downwardly into the other filter granulate so that the measured filter granulate filling 64 is placed in the tube 1 without leaving any residue.

When using a compressible filter granulate a correspondingly larger measured amount of filling 64 can be compressed in the tube since the inserting plunger 46 can be arranged to compress it by the action of the stopper element 65 (see Fig. 8L).

Then the inserting plunger 46 is moved back again to its starting position. During the following movement of the measuring bore 36 through the measuring zone P defined by the length of the exit duct of the filter granulate magazine 11 the measuring bore 36 is filled with a second filter granulate filling 67 in the same way as in the measuring zone R, which then falls into the tube 1 (see Figs. 2 and 8M). After filling, the lever 39 moves back to its starting position and the stopper element 66 is inserted by the plunger 46 through the measuring bore 36 into the tube 1. If the filter granulate filling 67 is compressible it may also be compacted (see Figs. 7 and 8N). The filling ring 25 and thus the tubes 1 located in the filling ring as well as the measuring bores 36 are set into vibration by the vibrator 55 so that the filter granulate is shaken down during the measuring and then in the tube 1 so that it reaches a uniform compactness.

During the further rotation of the filling drum 6 the support plunger 3 moves downwardly and the inserting plunger 46 also moves downwardly at the same speed so that the filter 68 produced (which may be a double-length filter) is slid into the groove 27 (Figs. 7 and 8O) from which the filter is withdrawn by the grooved drum 14 and moved past the heating drum 18. The tube is now completely filled and comprises terminal short stopper elements, a central stopper element of twice the length of the short end elements and two filter granulate fillings.

The heating drum 18 is only required for filters 68 in which the rods 15, shown in Fig. 9, are provided with narrow strips of thermoplastic adhesive 71 running at the periphery in the longitudinal direction, or if the tubes 1 as shown in Fig. 10 have narrow strips of thermoplastic adhesive 72 on the inner side. This adhesive is heated by the heating drum 18 which moves at a higher peripheral speed than that of the grooved drum 14 so that the filters 68 are rotated in the grooves 14*a*. Thereby the stopper elements 61, 65 and 66 are joined to the tube 1 so that they do not fall out during further handling and during smoking.

Fig. 11 shows part of another embodiment of a filling drum 206 which corresponds in construction to the filling drum 6 in Figs. 1 to 7. Hereinafter only the modified parts are described, the parts which are the same as in the previous embodiment bearing reference numerals increased by 200. The filling drum 6 differs from the filling drum 206 only because in the latter case, the vibrator 55 with the slip rings is omitted and in place thereof

the tubes 1 placed endwise over the support plungers 283, which correspond to the support plungers 3 in the filling drum 6, are suction operated. A flanged disc 265 is arranged on the cam disc 242 or on the tubular part thereof and is connected to the machine base 219. A sliding shoe holder 287 is supported over each of the measuring zones R and P which is pivotally mounted transversely to the axis of the shaft 221 of the filling drum 206. The shoe holder 287 embodies on the side facing the filling ring 225 a recess 286 in which a slider shoe 288 is fastened. A compression spring 285 is arranged between the shoe holder 287 and the flanged disc 265 which presses the shoe 288 against the inner side of the filling ring 225 which embodies a machined peripheral rib 284 in this region. The shoe 288 embodies a control slot 289 on the side facing the filling ring 225 which extends from the end of the measuring zone P or R to the point at which the next following stopper element 62 or 65 is inserted. The control slot 289 is connected at the other end to a suction source, not shown. A radial bore 292 is arranged in each groove 227 in the filling ring 225. Moreover a central bore 293 parallel to the axis and open at its upper end is located in the support plunger 283 which is in communication through a radial duct 294 with the bore 292 when the support plunger 283 is located in its uppermost position.

The method of operation of the filling drum 206 according to Fig. 11 corresponds to that described with reference to Figs. 1 to 7 with the difference that during the filling of the granulate into the tube 1 an air current is produced in the tube 1 through the slider shoe 288 and the bore 293 into the support plunger 283, which flows in the filling direction and thus assists and speeds up the filling of the filter granulate.

The filter production machine according to Figs. 12 to 14 also has a rotatably supported filling drum 102 supported on a vertical spindle 101 as the feed means for tubes and which also serves as an assembly conveyor. A grooved drum 103 is provided for feeding stopper-forming rods 182 to the drum 102 and a grooved drum 105 mounted on the same shaft 104 is provided for feeding the tubes 181. As in Figs. 1 to 7 the filling drum is associated with a circular cutter 106, a filter granulate magazine 107, a further circular cutter 108, a further filter granulate magazine 109 and a grooved drum 111, as seen in the said sequence in the feed direction. All these drums and circular cutters as well as a transfer drum 118 associated with the grooved drum 111 are rotatably supported on vertical spindles. A conical drum 112 is arranged at an angle of 45° to the shaft 104 and embodies uniformly distributed grooves so that its peripheral surface is vertical at the transfer point to the grooved drum 103 and is horizontal at the transfer point from a grooved magazine drum 113 which is rotatable about a horizontal axis and arranged at the delivery end of a magazine 114 for supplying rods 182.

The grooved drum 105 is associated with a conical drum 117, a magazine drum 116 and a magazine 115 for tubes 181 in the same way as the grooved drum 103. A corresponding conical drum 119 follows the transfer drum 118 as seen in the feed direction and is associated at the horizontal peripheral point with a take-off belt 121. The transfer drum 118 has narrow fins at its surface running parallel to its axis between which concentric rolling surfaces are located, the length of which corresponds approximately to the peripheral length of the filter. The peripheral surface of the transfer drum 118 is associated with a concentric stationary heated comb-shaped rolling member 122 the length of which corresponds to the length of the concentric rolling surface.

The section shown in Fig. 13 through the filling drum 102 is taken through the feed point for the rods 182 and the tubes 181 so that the grooved drums 103 and 105 are also shown. The shaft 101 is secured in a vertical upright position to a base member having a cylindrical edge portion 123 and carries a first bearing holder 124 on a step at the lower part thereof. A ball bearing 127 is secured to the bearing holder 124 and the latter has a wall running concentrically to the axis of the shaft 101 in the outer side of which there is formed a cam groove 132 extending around the whole periphery of the cylinder.

A further bearing holder 125 is fastened on the spindle above the bearing holder 124 which carries on the one hand a bearing 128 and on the other hand embodies a cam groove 133 on the upper surface of a flanged wall part.

A third bearing holder 126 is arranged at the upper part of the shaft 101 and is fixed to a plate 141 seated on the end of the shaft 101 being held from rotation by means of a key 135. A spindle 136 is screwed into the plate 141 and bears endwise against the shaft 101. As in the case of the bearing holders 124 and 126 a cylindrical wall is provided, the outer peripheral surface of which includes a cam groove 134. Moreover the bearing holder 126 incorporates a bearing 129.

The bearing holders 124, 125 and 126 are suitably fixed to the shaft 101 and thus do not rotate.

The drum body 131 is supported by the bearings 127, 128 and 129 and comprises the upper positioning section 137, the centre filling section 138 and the lower support means section 139. These parts are connected together by a tubular casing 140 which is as-

sembled from several parts. The filling section part 138 is located directly above the flange-like wall of the bearing holder 125 and is formed by a hollow ring-shaped casing part 142 which forms part of the casing 140 and is supported by the bearing 128. On its outer peripheral surface the casing part 142 embodies holders 144 distributed uniformly around the periphery and extending parallel to the axis and which consist in each case of a lower grooved part and an upper part of closed ring shape.

Each holder 144 is continued upwardly by a duct 148 coincident therewith. The duct 148 ends directly beneath a measuring bore 146 which is coincident with the holder 144 and the duct 148 and tapers slightly in the downward direction. The measuring bore 146 is separated from the duct 148 by a narrow groove 147 running around the whole of the casing part 142 and which is engaged in the measuring region by a stationary plate. The measuring bore 146 serves as the measuring means for the filter granulate. The top openings of the measuring bores 146 sweep over the circular cutters 106, 108 shown in Fig. 12. A holder 149 includes protrusions 151 with apertures for the rods 182; these apertures are located at a small distance from the measuring bores 146 and coincident in each case with one of the measuring bores. Each of a series of holders embodies an upper grooved part and a lower protrusion 151. The holders 149 are fastened in groups of four to levers 152 which are secured in each case to shafts 153 supported in the casing part 142 (see also Fig. 14). The lower ends of the shafts 153 are fixed to cranked levers 154 carrying rollers 155 which engage the cam groove 133.

A guide ring 156 is located within the upper part of the casing part 142 and is screwed to it and embodies on its inner side the bearing surfaces for the bearings 129. Two series of bores 157, 158 arranged parallel to the axis of the filling drum 102 are disposed in each case at a pitch spacing of four holders 144 in the guide ring 156 the bores being arranged with their centres on lines radial to the filling drum. Further bores 159 coincident with the outer bores 157 are located in the upper flange-like end part of the casing section 142. A guide rod 161 is supported in each bore 158, a further guide rod 162 is supported in each pair of bores 157 and 159; a coupling plate 163 is secured to the lower ends of the guide rods 161 and 162. A block 164 is fitted to each guide rod 161 between the bores 157, 159 and carries a roller 165 engaging the cam groove 134. Four axially parallel downwardly projecting feed plungers 166 are mounted on each of the coupling plates 163 each coincident with one of the holders 144. The feed plungers 166 are guided at their lower ends in bores located above the holders 149 in a wall of the casing 140 running transversely to the spindle 101 and provide a dust-proof passage for the feed plungers 166.

In the same way a guide ring 167 is provided in the support section 139 of the filling drum 102 to which one outer ring member of the ball bearing 127 is screwed and which is screwed at the other end to the casing 140. Guide rods 172, 173 are supported in bores 168, 171 and 169 of a guide ring 167 and the casing 140, similarly to the arrangement in the positioning section 137, each pair of which in this case embodies at their upper ends a coupling plate 174. Likewise each guide rod 172 embodies a block 175 carrying a freely rotatable roller 176 which engages the cam groove 132. Four support plungers 177 are secured to each coupling plate 174, running parallel to the axis 101 and coincident in each case with one of the holders 144.

A toothed ring 178 is arranged at the lowermost end of the casing 140 which is engaged by a gear wheel, not shown, for driving the drum body 131.

Fig. 14 shows the holders 149 with the levers 152 in the region of the circular cutter 106. It will be seen from this figure in conjunction with Fig. 13 that the levers 152 are cranked in order that they can swing without conflicting with one another.

The method of operation of the device according to Figs. 12 to 14 is as follows: the tubes 118 enter from the magazine 115 of a tube production machine. The tubes 181 are delivered transversely to their axes to the magazine drum 116 and supplied by the latter to the conical drum 117 which changes the feed plane of the tubes 181 so that they pass with their longer axes upright to the grooved drum 105 which delivers them as shown in Fig. 13 to the holders 144 of the filling drum 102.

Rods 182 of stopper or filter material are supplied to the magazine 114 which stopper elements are to be cut, and are withdrawn transversely to their longitudinal axes from the magazine 114 by the magazine drum 113, delivered to the conical drum 112, moved by the latter from the feed plane through an angle of 90° to a horizontal feed plane and then delivered by the grooved drum 103 to the holders 149 of the filling drum 102. During these movements the tubes 181 and also the rods 182 are held by suction in the grooves of the drums. Directly beyond the delivery points both the tubes 181 in the holders 144 and the rods 182 in the holders 149 are held by stationary guides. During the rotation of the filling drum 102 the guide rods 172 and 173 and the coupling plates 174 with the support plungers 177 move upwardly by the action of the cam groove 132 whereby four tubes 181 in each case are slid up-

wardly at their upper ends into the ring-shaped region of the holders 144. The support plungers 177 remain in the upper position until the filters are finished. Simultaneously the feed plungers 166 together with the coupling plates 163 and the guide rods 161, 162 move downwardly by the engagement of the respective roller 165 in the cam groove 134 and thus push four rods through the ring-shaped region of the holders 149 and place the end part of each rod in the respective measuring bore 146.

During further rotation of the filling drum 102 the parts of the rods 182 located in the measuring bores 146 are cut off by the circular cutter 106. Then the four feed plungers 166 are slightly raised and the levers 152 each with four holders 149 supporting the remaining parts of the rods 182 are swung out of the region between the feed plungers 166 and the measuring bores 146 by the action of the cam groove 133. As soon as the way is clear for the feed plungers 166 they move down again so far as to push the four rod portions (the first stopper element in each case) located in the measuring bores 146 concerned to the lowest part of the tubes 181.

The feed plungers 166 are now again moved to their upper positions. The measuring bores 146 then move past the filling region in which the outlet opening of the filter granulate magazine 107 is located directly above the feed path of the measuring bores 146. In the filling region and for a short portion beyond the filling region the measuring bores 146 are closed from beneath by a stationary plate (like 54, 63 of Fig. 1) extending into the groove 147 so that a measuring chamber 145 is formed which in the filling region is filled with filter granulate.

The filter granulate spreading above the measuring chamber 145 is swept off by a wall of the filter granulate magazine 107 so that a measured granulate filling is obtained which falls into the tube 181 without passing off the end of the plate. After measuring, the holders 149 swing back again to their starting position and the feed plungers 166 push a major portion of each of the remaining parts of the rods 182 into the measuring bores 146 to form central stopper elements. In this case the portions inserted into the measuring bores are twice the length of the first and last stopper elements. The parts now standing in the bores are cut off by the circular cutter 108 and the parts remaining in the holders 149, now a single stopper element in each case, are swung out of the region between the feed plungers 166 and the measuring bore 146. The cut-off portion located in the measuring bore is now pushed into the tube 181 by the plunger 166.

The same procedure is now followed for the filter granulate magazine 109 as in the case of the magazine 107 so that a further filter granulate filling is inserted into the tube 181. Beyond the filter granulate magazine 109 the holder 149 is again swung back to its starting position and the last stopper element pushed into the tube 181 which is now completely filled and comprises terminal short stopper elements a central stopper element of twice the length of the short end elements and two filter granulate fillings.

Compressible filter granulates can also be used with this equipment. In this case a larger amount of filter granulate than the amount of room provided in the tube is filled in the uncompressed condition into the tube and the filter granulate is compressed by the stopper elements inserted after the filter granulate fillings.

After inserting the last stopper element, four filters at a time are ejected from the ring-shaped parts of the holders 144 by the downward movements of the support plungers 177 and are then delivered to the grooved drum 111 from which they are transferred to the take-off drum 118 and rotated once around their axes between the comb-shaped rolling member 122 and the rolling surfaces of the take-off drum 118. In this case the filters are heated by the heated rolling member 122 and a thermoplastic adhesive applied to the inner side of the tube 181 or the outer sides of the defining elements is activated so that on cooling a positive connection is provided between the defining elements and the tube 181. The finished filters are carried off by the conical drum 119 and transferred to the take-off belt 121 on which the filters are conveyed with their axes horizontal.

The uppermost part of the casing 140 may be released when required and the bearing holder 126 with the cam member 134 and the feed plungers 166 lifted by the spindle 136 so that the feed plungers are removed from the measuring bores 146 which can then be cleaned.

Fig. 15 shows a further arrangement of a detail of a filter production machine which can be constructed in the same way as shown in Figs. 11 to 14. In this construction the grooved drum 111 is modified by providing needles 185 in the grooves in the region at which the stopper elements are placed. This grooved drum is associated with a needle drum 186 which embodies needles 187 opposite the needles 185 of the grooved drum 111. The filters 189 are held in this region by guides 188. Filters collected by means of a grooved drum 111 formed in this way are perforated in the region of the stopper elements. Thereby the walls of the tube 181 are locally compressed towards the stopper elements 184 so that a connection is produced between the tube 181 and the elements 184 which fit closely one against the other. By the perforation of the needles 187 of the

needle drum 186 the opposite side of the tube 181 is compressed towards the stopper element 184 so that a close fit is obtained at two opposite points. If this filter 189 is later connected to a cigarette by means of a gummed wrapper sheet these perforations become filled with gum so that there is local adhesive connection of the element 184 with the tube 181 and moreover the shape of the depressed wall parts is stiffened after hardening of the gum. In Fig. 15 one of the elements 184 is partly broken away to show a granulate filling 183.

The filter production machine described has the advantage that the whole space provided for receiving the filter granulate is completely filled by reason of the endwise filling action and that the stopper elements are placed tight up to the filling so that no air pockets are formed in the region of the granulate which would reduce the effectiveness of the filtering action. Moreover by varying the size of the measuring bores and the cams operating the feed plungers any desired degree of granulate filling can be attained including comparatively large fillings and a wide range of filling of granulates or other powder fillings can be handled.

The filter production machine is reliable and not liable to accidental disturbances because all the parts of the filter are positively guided from the moment when they are withdrawn from the magazines. Because of the positive guiding no chain reaction of disturbances is possible, as for example if a rod is withdrawn in a damaged state from the supply, that is from the magazine. A particularly quiet operation is obtained with the filter production machine described, by reason of the continuous operation thereof which permits comparatively high working speeds to be adopted and moreover ensures satisfactory handling of the tubes, of the rods and of the stopper elements cut therefrom, of the granulate as well as of the finished filters since they are not subjected to any sudden accelerations or retardations. This ensures economical usage of the filter granulates or powders and minimises soiling of the machines by loss of granulate or powder.

The insertion of stopper elements parallel one to the other and the simultaneous measurement of several filter granulate fillings allows sufficient time for the individual working operations to be correctly carried out even at high working speeds and at the maximum feed speeds and measuring speeds an output can be obtained which is several times that possible with other equipment. Moreover with the machine constructed according to the invention a simple constructional arrangement is provided in that several units operating simultaneously, for example plungers or holders are combined to form groups.

A further advantage of the filter production machine according to the invention is that the whole production procedure is effected on a conveyor so that in the first place the transfer of intermediate products from one conveyor to another is eliminated and in the second place all the means can be aligned one with the other since they move in the same circular path and in the third place a very simple constructional arrangement is provided. Furthermore it becomes unnecessary to provide means for supplying the filter granulate in the lateral direction since the filter granulate enters the tubes by gravity this resulting from the arrangement of the filling drum on a vertical axis and the particular arrangement of the tubes.

Since the defininin elements to be inserted in the tube are cut from a rod section only a single feed point for the rods is necessary. These rods can be more easily handled during feeding and transfer than when comparatively short defining elements are in use.

WHAT WE CLAIM IS:—

1. Method for producing filters for attachment to tobacco articles comprising supplying to a filling point a succession of preformed tubes having a stopper element therein, supporting and conveying each tube in an upright position, and inserting a filter granulate and a further stopper element into each tube while being conveyed.

2. Method for producing filters for attachment to tobacco articles, comprising supporting and conveying a succession of preformed tubes in an upright position, and inserting into each tube in succession a stopper element, filter granulate and a further stopper element.

3. A method according to claim 1 or 2, comprising cutting slices from a rod of stopper element material to form successive stopper elements, inserting one such stopper element lengthwise of the tube from the upper end, causing the granulate filling to flow into the space in the tube above said stopper element, and inserting a further slice of stopper element material to confine the filter granulate tightly between the stopper elements, and wherein each successive slice of stopper element material is cut while the rod is aligned with the tube, the stopper element so formed is inserted into the tube, the remaining portion being moved laterally during the insertion of the filter granulate into the tube and being thereafter returned, a further slice cut off and this slice inserted into the tube.

4. A method according to any of the foregoing claims, wherein the tubes are fed to a conveyor adapted to support the tubes in a vertical position, said conveyor further receiving rods of stopper element material which are supported in axial alignment with

the tubes and are movable axially relatively to them so that one end part of each stopper element rod is located in line with the upper end of each tube and the portion of the rod above said end part is cut off to form a stopper element and then moved laterally out of the way, after which the said stopper element is pushed into the tube in the downward direction, the tube passes to a filling position and a quantity of filter granulate deposited in the tube above said stopper element whereafter the rod is brought again into alignment with the tube, a portion to form a further stopper element is cut off and pushed down into the tube and a further filling of filter granulate supplied, after which the remainder of the rod is inserted as a further stopper element into the upper end of the tube, thereby to form a double filter which comprises terminal stopper elements, a central stopper element, and two fillings of filter granulate.

5. A method according to claim 4, wherein the conveyor is a rotary conveyor which is adapted to receive the tubes and the rods of stopper element material, and these elements are carried in a rotary path past successive means for cutting slices of stopper element rod material and a magazine for supplying filter granulate material for insertion into the tubes after slices of stopper element material have been pushed downwardly into the tubes.

6. Method according to any of the foregoing claims, in which the filter granulate is supplied into measuring compartments and thereafter fed into the tubes.

7. Method according to claim 6, in which several charges of filter granulate are simultaneously measured, and then fed into tubes.

8. Method according to claim 6 or 7, in which the measuring compartments are in alignment with the tubes during filling.

9. Method according to any of the foregoing claims, in which measuring compartments are disposed above the tubes and the filter granulate falls into the tubes from the compartments by the action of gravity.

10. Method according to any of the foregoing claims, in which the filter granulate is compressed after insertion into the tubes.

11. Method according to any of claims 1 to 5, in which the stopper elements are conveyed in alignment with the tubes before and during the insertion of the said elements into the tubes at the filling point.

12. Method according to claim 11, wherein the stopper elements and the tubes arrive in different paths, are then conveyed in coincident paths and in axial alignment, portions of stopper elements and filter granulate are inserted into the tubes and the composite filters so formed are carried onward for further treatment.

13. Method according to any of claims 1 to 5 or 11, in which the stopper elements are supplied in the form of a rod and in each case a stopper element is cut from the rod directly before insertion into the tube or after a short portion has entered the tube, and the remaining part of the rod is removed from this position, after which the cut portion is displaced axially within the tube.

14. Method according to any of the foregoing claims, in which a stopper element is caused to follow the path traversed by the filter granulate whereby any residual granulate is swept into the tube.

15. Method according to any of the foregoing claims, in which the insertion of the filter granulate fillings into the tubes is assisted by pneumatic action, for example by suction.

16. Method according to any of the foregoing claims, in which vibrator means are provided to vibrate the tubes or associated parts during the insertion of the filter granulate into the tubes.

17. Method according to any of the foregoing claims, in which the inner walls of the tubes or the peripheral surfaces of the stopper elements are provided with a suitable preferably thermoplastic adhesive.

18. Method according to claim 17, in which the adhesive is activated for example by heat after insertion of the defining elements.

19. Method according to any of the foregoing claims, in which the tube walls are compressed locally radially into engagement with the stopper elements after insertion of the latter.

20. Method according to any of the foregoing claims, in which the stopper elements are positioned at perforated sections of the tube.

21. Method according to claim 20 in which each tube is perforated by needle-like elements adapted to penetrate the tube walls and enter the stopper elements to grip the latter and to provide crevices to receive gum from a subsequently applied wrapper sheet.

22. Method according to any of the foregoing claims, in which all the component parts of the filter are in continuous movement during the production of the filters.

23. Method according to any of the foregoing claims, in which each tube is moved transversely to its axis during the production of the filter.

24. Apparatus for producing filters for attachment to tobacco articles comprising a conveyor adapted to receive pre-formed tubes to be filled with granulate and supported in an upright position on the conveyor each having a stopper element therein before reaching a filling point and means at said filling point for inserting suc-

cessively into the tubes from the upper ends while being conveyed a quantity of filter granulate and a further stopper element.

25. Apparatus according to claim 24, wherein the conveyor means includes coordinately arranged tubes and rods of stopper element material from which successive slices are cut to form stopper elements, means for displacing such cut slices downwardly within the tubes and means for supplying portions of filter granulate into the tubes following respective stopper elements and thereafter inserting a further stopper element in each tube.

26. Apparatus according to claim 25, wherein the stopper rods are supported coaxially with and above the tubes, and are adapted to be displaced laterally after stopper element slices have been cut therefrom and inserted into the tubes, to provide a clear space for filling the tubes with filter granulate and for the displacement of plungers for moving the stopper elements downwardly within the tubes.

27. Apparatus according to claim 26, wherein the plungers are arranged to insert into a first short portion of the rod a holder, and including means to cut off the so inserted portion and to move the remainder laterally out of the way of the plunger which then pushes the cut-off portion downwardly into the tube and means to insert into each tube a further stopper element cut from the rod after the filter granulate filling has been fed into the tube.

28. Apparatus for producing filters for connection to cigarettes or other rod-like tobacco-containing articles, such filters comprising tubes produced by a casing material such as paper closed at the ends by stopper elements and containing a filter granulate filling, such apparatus comprising feed means for the tubes, embodying at least one holder arranged for conveying the tubes in the upright position, measuring means for the filter granulate fillings arranged beside the feed path for the holders and adapted to deliver the measured quantities endwise into tubes located in the holders during the transfer of a filter granulate into the tubes, and means for placing stopper elements in such tubes.

29. Apparatus according to claim 26 or 27, comprising a group of plungers movable in the direction of the axes of the holders, all the plungers of each group being movable together.

30. Apparatus according to any of claims 24 to 29, comprising feed means for the tubes embodying at least one holder arranged for conveying the tubes transversely to their axes, means for measuring out portions of filter granulate, and means for inserting the stopper elements, in which holders are provided for the stopper elements to place them coincidently with the axes of the tubes and movably arranged so as to move away from the axes of the tubes for shifting unused portions of the stopper elements away from the axes of the tubes.

31. Apparatus according to any of claims 24 to 30, in which a short length of stopper material is cut off and inserted into each of the tubes, one or more fillings of granulate are inserted into each tube, both operations being effected in the direction of the axes of the tubes and in which a remainder of the stopper material is swung laterally away from the tube axis during insertion of the granulate filling.

32. Apparatus according to claim 31 in which means are provided for inserting a short portion cut from a rod of stopper material into said tube whereafter the portion already cut is pushed lengthwise into the tube for providing a space for receiving the granulate filling and the remainder of the rod is moved laterally to allow such insertion of granulate filling, being later moved back to the axis and a further portion cut off therefrom which is thereafter pushed into the tube.

33. Apparatus according to claim 28 or 30, in which the measuring means are movable in step with the holders.

34. Apparatus according to any of claims 28, 30 or 33, in which the measuring means comprises at least one measuring chamber arranged on the feed means for the tubes and which is brought momentarily into communication with an outlet duct of a filter granulate magazine.

35. Apparatus according to claim 34, in which the measuring means comprise a series of bores in a continuously moving member adapted to receive quantities of granulate from the magazine by moving transversely across the base of the outlet duct, surplus granulate being swept from the upper surfaces of the bores as they move past a terminal wall of the outlet duct.

36. Apparatus according to claim 34 or 35, in which the bores are closed from beneath by a stationary plate and as they rotate coincidently with and above the tubes to be filled the bores pass away from a terminal edge of the stationary plate and the granulate in the measuring bores falls into the tubes lying respectively beneath them.

37. Apparatus according to claim 36 in which ducts or passages are provided between the measuring chambers and the holders for the tubes.

38. Apparatus according to any of claims 26, 27 or 29, in which the plunger or the group of plungers is movable over a stationary control cam for actuation of the plunger or plungers, and the control cam and the plungers are arranged to move relatively to the holders in the direction of the longitudinal axis of the apparatus.

39. Apparatus according to any of claims

30 to 32, in which the holders for the stopper elements are arranged to move in unison with the holders for the tubes and are displaceable transversely to the axes of the latter.

40. Apparatus according to any of claims 30 to 32 and claim 39, in which several holders for stopper elements are combined into groups, and each holder for the stopper elements is associated with a holder for the tubes.

41. Apparatus according to any of claims 30 to 32 and claim 39 or 40, in which the holders for the stopper elements and the holders for the tubes are coincident for part of their coordinate movement and the first said holders are movable laterally away from this position.

42. Apparatus according to any of claims 30 to 32 and any of claims 39 to 41, in which the holders for the stopper elements comprise a closed ring-shaped portion and a channel portion.

43. Apparatus according to any of claims 28 to 42, in which the holders for the tubes are associated with or form part of a continuously operated conveyor where assembly of the parts of the filter is effected.

44. Apparatus according to claim 43, in which each holder for the tubes is defined at one end by a positively movable support plunger.

45. Apparatus according to claims 43 or 44, in which the tube holders are associated with pneumatic or suction means.

46. Apparatus according to any of claims 43 to 45, comprising a vibrator device operative on the tube holders.

47. Apparatus according to any of claims 43 to 46, in which locating means, for example needles, are provided for the filters in the region of the stopper elements which needles project into the feed path of the filters.

48. Apparatus according to any of claims 43 to 47, in which heating means are associated with the feed means for the tubes.

49. Apparatus for producing filters for connection to cigarettes or other tobacco containing articles such filters comprising a filter granulate filling closed at the ends by means of stopper elements, comprising a drum rotatably supported on a vertical axis, holders on said drum adapted to receive and convey paper or like tubes in an upright position, means associated with each holder for measuring a filter granulate filling, holders for stopper elements, portions of which are adapted to be inserted into the tubes, and plungers coincident with the tubes for inserting the portions of stopper elements into the tubes such holders for the stopper elements being displaceable away from a position coincident with the tubes to allow for movement of the plungers.

50. Apparatus according to claim 49, in which several plungers and several holders for stopper elements are assembled to form simultaneously displaceable groups.

51. Apparatus according to claim 50, in which the groups of plungers move axially towards and away from an inserting position and the holders move laterally towards and out of the path of said plungers.

52. Apparatus according to claim 49, in which a rotatable circular cutter fixed in position relatively to the drum is provided in the region of the holders for the stopper elements for cutting portions successively from such elements for insertion into the tubes.

53. Apparatus for producing filters for attachment to cigarettes or other tobacco-containing articles comprising a continuously rotating drum supported on a vertical axis having holder means for supporting a continuous series of tubes in the upright position, and coincidently with said tubes a similarly positioned series of permeable stopper rod elements suitable for forming stopper elements, means for supplying empty tubes and stopper rods to said drum, means for cutting successive stopper elements from said stopper rods, said stopper elements being inserted by plunger means endwise into the respective tubes, granulate measuring means comprising measuring bores positioned coincidently with the holders for the tubes and the stopper rods, said measuring means being caused to move past an outlet duct of a stationary magazine for filter granulate whereby such measuring bores are filled with granulate and then emptied into the tubes and both before and after such filling of the tubes with the filter granule a stopper element is inserted therein wherein finished filters are produced during the movement of the tubes on said conveyor drum, the finished filters comprising at least one granulate filling and at least two stopper elements at the two ends of said granulate filling, the finished filters being thereafter removed from the drum.

54. Apparatus according to claim 53, wherein the supply of the tubes and of the stopper rod elements towards the drum is effected in a horizontal plane and rotation of these elements through 90° to upright positions is effected by means of bevelled drums, one surface part of which lies in a horizontal plane and another surface part of which lies in a vertical plane, the said components being transferred while in the vertical plane to transfer drums and thence to the aforesaid drum and in which the finished filters are collected from the said drum by further transfer drums and are changed from the vertical to the horizontal position by a further bevelled drum.

55. Apparatus for producing a filter element for cigarettes or other tobacco articles, embodying at least one charge of a filter granulate which is retained in a pre-formed

tube by air permeable stopper elements, comprising continuously rotating feed means with holders for receiving a series of tubes and for moving them transversely in the upright position, supply means for inserting granulate charges into the tubes and continuously moving feeder means for inserting air permeable stopper elements into the tubes to retain the granulate charges therein, and in which said feeder means are arranged co-axially of the said holders and move synchronously with them.

56. Method for producing filters for tobacco articles including a filter granulate filling, substantially as herein described.

57. Apparatus for producing filters including granulate filled compartments, substantially as herein described with reference to the accompanying drawings.

Chartered Patent Agents,
WHEATLEY & MACKENZIE,
17 Wilson Street,
London, EC2M 2TS.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1971.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1243977 COMPLETE SPECIFICATION

6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1

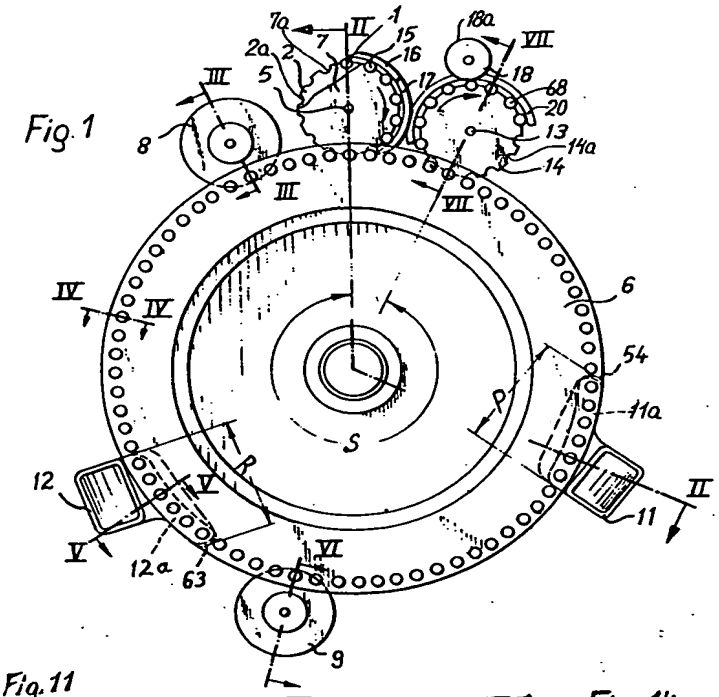


Fig. 11

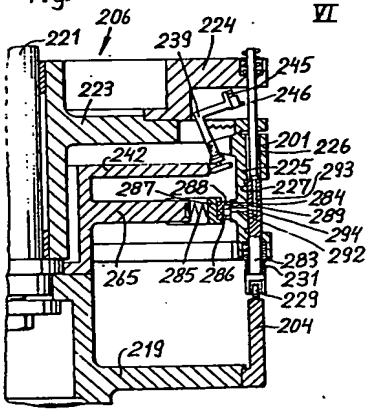
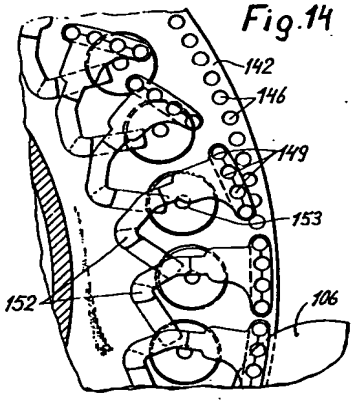
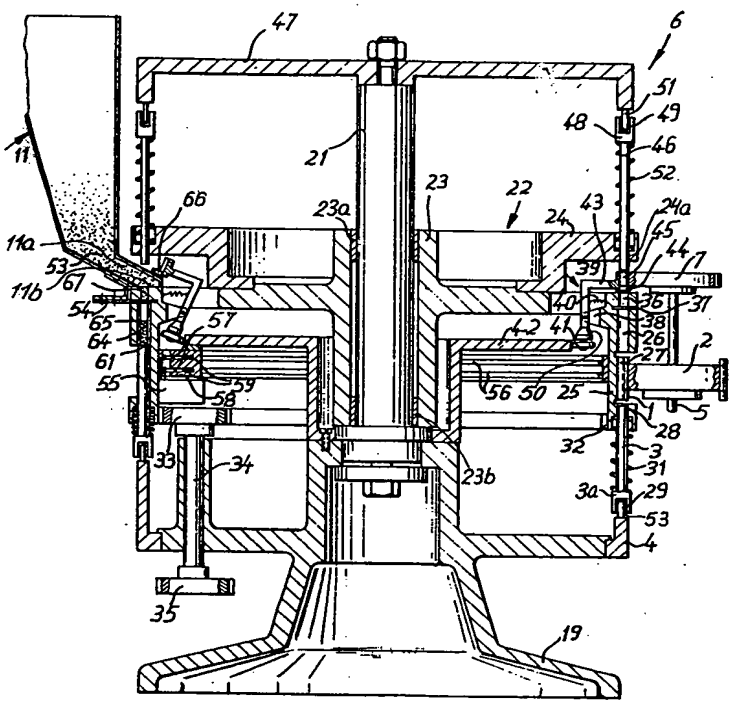


Fig. 14



1243977 COMPLETE SPECIFICATION
6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

Fig. 2



1243977 COMPLETE SPECIFICATION
6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

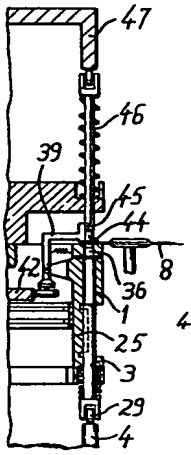


Fig. 3

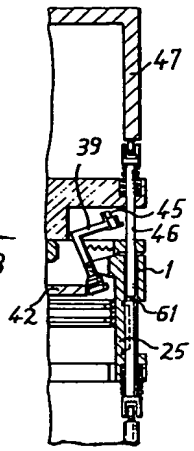


Fig. 4

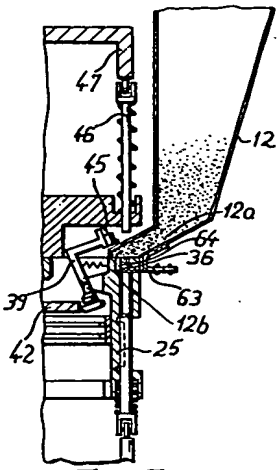


Fig. 5

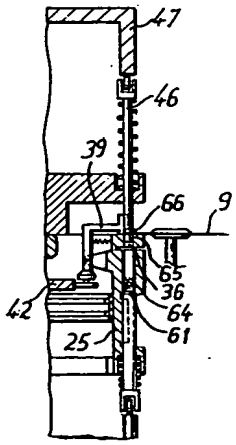


Fig. 6

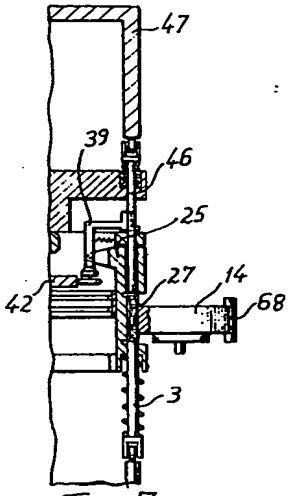
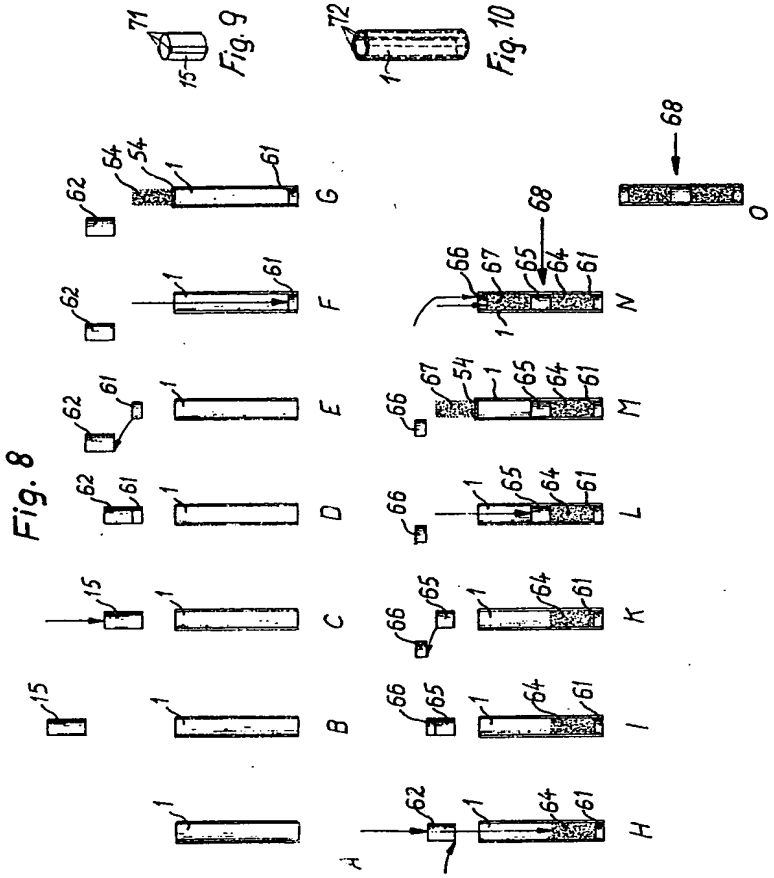


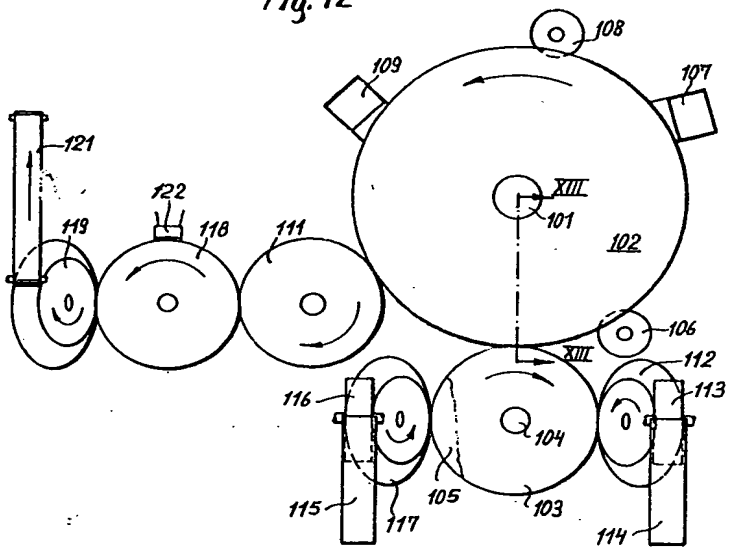
Fig. 7

1243977 COMPLETE SPECIFICATION
6 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 4



1243977 COMPLETE SPECIFICATION
6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 5

Fig. 12



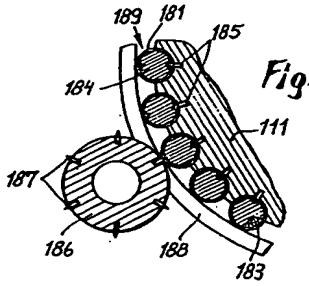


Fig. 15

1243977 COMPLETE SPECIFICATION
6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 6

Fig. 13